

**Applicant Initiated Interview Request Form**Application No.: 10/594,711First Named Applicant: Ryoichi OKUYAMA et alExaminer: Amanda J. BARROWArt Unit: 1795Status of Application: Pending**Tentative Participants:**(1) Manabu KANESAKA

(2) \_\_\_\_\_

(3) \_\_\_\_\_

(4) \_\_\_\_\_

Proposed Date of Interview: August 30, 2010Proposed Time: 10 (AM/PM)**Type of Interview Requested:**(1) ☐ Telephonic(2) ☒ Personal(3) ☐ Video ConferenceExhibit To Be Shown or Demonstrated: ☐ YES☒ NO

If yes, provide brief description: \_\_\_\_\_

**Issues To Be Discussed**

Issues (Rej., Obj., etc)	Claims/ Fig. #s	Prior Art	Discussed	Agreed	Not Agreed
(1) <u>REJ</u>	<u>Claim 48</u>	<u>A,U</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
(2) _____	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(3) _____	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(4) _____	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

☐ Continuation Sheet Attached☒ Proposed Amendment or Arguments Attached**Brief Description of Arguments to be Presented:**Claim 48 is not disclosed by references A, U.

An interview was conducted on the above-identified application on \_\_\_\_\_.

**NOTE:** This form should be completed by applicant and submitted to the examiner in advance of the interview (see MPEP § 713.01).

This application will not be delayed from issue because of applicant's failure to submit a written record of this interview. Therefore, applicant is advised to file a statement of the substance of this interview (37 CFR 1.133(b)) as soon as possible.



Applicant/Applicant's Representative Signature

Examiner/SPE Signature

Manabu KANESAKA

Typed/Printed Name of Applicant or Representative

31,467

Registration Number, if applicable

This collection of information is required by 37 CFR 1.133. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 21 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PROPOSED AMENDMENT  
Serial No. 10/572,378

IN THE UNITED STATES PATENTS AND TRADEMARK OFFICE

KPO-005

Applicant : Ryoichi OKUYAMA et al.

Title : HYDROGEN SUPPLY SYSTEM

Serial No. : 10/594,711

Filed : September 28, 2006

Group Art Unit : 1795

Examiner : Amanda J. BARROW

Hon. Commissioner for Patents  
P.O. Box 1450, Alexandria, VA 22313-1450

August 2, 2010

PROPOSED AMENDMENT

Sir:

In response to the Office Action of July 1, 2010, please  
amend the application, as follows:

Amendments to the Claims

Remarks

**AMENDMENTS TO THE CLAIMS:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

1 to 47 (Canceled)

48. (Currently amended) A hydrogen supply system ~~provided with~~ comprising at least hydrogen supply means for supplying hydrogen to hydrogen storing means and a hydrogen generating device producing hydrogen containing gas to be supplied to the hydrogen supply means, wherein the hydrogen generating device produces the hydrogen containing gas by decomposing a fuel containing an organic compound and comprises a partition membrane, a fuel electrode provided on one surface of the partition membrane, means for supplying a fuel containing the organic compound and water to the fuel electrode, an oxidizing electrode provided on the other surface of the partition membrane, means for supplying an oxidizing agent to the oxidizing electrode, and means for collecting the hydrogen containing gas from the fuel electrode.

49. (Canceled)

50. (Currently amended) ~~The~~ A hydrogen supply system ~~as described in Claim 48,~~ comprising at least hydrogen supply means for supplying hydrogen to hydrogen storing means and a hydrogen generating device producing hydrogen containing gas to be supplied to the hydrogen supply means,

wherein the hydrogen generating device produces the hydrogen containing gas by decomposing a fuel containing an organic compound and comprises a partition membrane, a fuel electrode provided on one surface of the partition membrane, means for

supplying a fuel containing the organic compound and water to the fuel electrode, an oxidizing electrode provided on the other surface of the partition membrane, means for supplying an oxidizing agent to the oxidizing electrode, and means for collecting the hydrogen containing gas from the fuel electrode, and

wherein the hydrogen generating device is an open circuit having neither means for withdrawing electric energy to outside from a hydrogen generating cell constituting the hydrogen generating device, nor means for providing electric energy from outside to the hydrogen generating cell.

51. (Previously presented) The hydrogen supply system as described in Claim 48, wherein the hydrogen generating device has means for withdrawing electric energy to outside with the fuel electrode serving as a negative electrode and the oxidizing electrode as a positive electrode.

52. (Previously presented) The hydrogen supply system as described in Claim 48, wherein the hydrogen generating device has means for providing electric energy from outside with the fuel electrode serving as cathode and the oxidizing electrode as anode.

53. (Canceled)

54. (Previously presented) The hydrogen supply system as described in Claim 48, wherein voltage between the fuel electrode and the oxidizing electrode is 200 to 1000 mV in the hydrogen generating device.

55. (Previously presented) The hydrogen supply system as described in Claim 50, wherein voltage between the fuel electrode

and the oxidizing electrode is 300 to 800 mV in the hydrogen generating device.

56. (Previously presented) The hydrogen supply system as described in Claim 51, wherein voltage between the fuel electrode and the oxidizing electrode is 200 to 600 mV in the hydrogen generating device.

57. (Previously presented) The hydrogen supply system as described in Claim 51, wherein voltage between the fuel electrode and the oxidizing electrode and/or the evolution volume of hydrogen-containing gas are/is adjusted by varying the volume of electric energy withdrawn from the hydrogen generating device.

58. (Previously presented) The hydrogen supply system as described in Claim 52, wherein voltage between the fuel electrode and the oxidizing electrode is 300 to 1000 mV in the hydrogen generating device.

59. (Previously presented) The hydrogen supply system as described in Claim 52, wherein voltage between the fuel electrode and the oxidizing electrode and/or the evolution volume of hydrogen-containing gas are/is adjusted by varying the volume of electric energy provided in the hydrogen generating device.

60. (Previously presented) The hydrogen supply system as described in Claim 48, wherein the evolution volume of hydrogen-containing gas is adjusted by varying voltage between the fuel electrode and the oxidizing electrode in the hydrogen generating device.

61. (Previously presented) The hydrogen supply system as described in Claim 48, wherein voltage between the fuel electrode and the oxidizing electrode and/or the evolution volume of hydrogen-containing gas are/is adjusted by varying the supply volume of the oxidizing agent in the hydrogen generating device.

62. (Previously presented) The hydrogen supply system as described in Claim 48, wherein voltage between the fuel electrode and the oxidizing electrode and/or the evolution volume of hydrogen-containing gas are/is adjusted by varying the concentration of the oxidizing agent in the hydrogen generating device.

63. (Previously presented) The hydrogen supply system as described in Claim 48, wherein voltage between the fuel electrode and the oxidizing electrode and/or the evolution volume of hydrogen-containing gas are/is adjusted by varying the supply volume of fuel containing an organic compound and water in the hydrogen generating device.

64. (Previously presented) The hydrogen supply system as described in Claim 48, wherein voltage between the fuel electrode and the oxidizing electrode and/or the evolution volume of hydrogen-containing gas are/is adjusted by varying the concentration of fuel containing an organic compound and water in the hydrogen generating device.

65. (Previously presented) The hydrogen supply system as described in Claim 48, wherein the operation temperature of the hydrogen generating device is not higher than 100°C.

66. (Canceled)

67. (Previously presented) The hydrogen supply system as described in Claim 48, wherein the organic compound supplied to the fuel electrode of the hydrogen generating device is one or two or more organic compounds selected from a group consisting of alcohol, aldehyde, carboxyl acid and ether.

68. (Canceled)

69. (Previously presented) The hydrogen supply system as described in Claim 48, wherein the oxidizing agent supplied to the oxidizing electrode of the hydrogen generating device is an oxygen-containing gas or oxygen.

70. (Canceled)

71. (Previously presented) The hydrogen supply system as described in Claim 48, wherein the oxidizing agent supplied to the oxidizing electrode of the hydrogen generating device is a liquid containing hydrogen peroxide solution.

72. (Previously presented) The hydrogen supply system as described in Claim 48, wherein the partition membrane of the hydrogen generating device is a proton conducting solid electrolyte membrane.

73-79. (Canceled)

REMARKS

In the First Action Interview Pilot Program Pre-Interview Communication, claim 50 was objected to as being dependent upon a rejected base claim, but was indicated allowable if rewritten in independent form. In view of the objection, claim 50 has been amended in independent form.

Regarding the § 102 anticipation rejection of claims 48, 52, 67, 69, and 72 over Kosek et al. (US 2003/0062268), the hydrogen generating stack 12 which generates hydrogen by degrading methanol disclosed in Kosek, generates hydrogen by electrolysis, and the principle of the hydrogen generating stack 12 differs from that of "a hydrogen generating device" which is used in the hydrogen supply system of the present invention. Further, in the "Chemical Reaction" of a cited reference U, there is no disclosure which prevents the patentability of the present invention.

Kosek discloses in paragraph 34 that "in still other alternative embodiments of the invention, a methanol/hydrogen stack may be used, in which methanol is oxidized at the anode to produce protons, electrons and carbon dioxide, and hydrogen gas is evolved at an elevated pressure at the cathode by reduction of the protons with the electrons."

According to the above-mentioned disclosure, reactions of  $\text{CH}_3\text{OH} + \text{H}_2\text{O} \rightarrow \text{CO}_2 + 6\text{H}^+ + 6\text{e}^-$  at an anode (fuel electrode), and  $6\text{H}^+ + 6\text{e}^- \rightarrow 3\text{H}_2$  in a cathode (oxidizing electrode) occur, and hydrogen gas ( $\text{H}_2$ ) is generated at the cathode (oxidizing electrode).

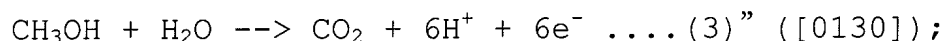
Since Kosek discloses in paragraph 17 that "a power conditioner 28 provides the power required for electrochemical hydrogen generation and compression", in order to generate hydrogen gas ( $\text{H}_2$ ) by the above-mentioned electrochemical reaction,



electrons ( $6e^-$ ) with an amount required for the above-mentioned cathode reaction are supplied by the power conditioner 28.

Then, the generated hydrogen gas ( $H_2$ ) is taken out from the cathode (oxidizing electrode) (see Fig. 1 of Kosek).

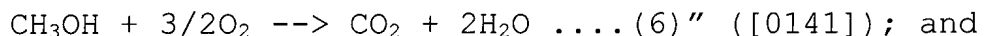
On the other hand, the present application discloses that "with regard to a DMFC using a proton conducting solid electrolyte membrane such as Nafion, there is known a phenomenon called methanol crossover, that is, the crossover of methanol from the fuel electrode to the oxidizing electrode. Thus, it is possible that crossed over methanol undergoes electrolytic oxidization represented by the following formula on the oxidizing electrode.



"The  $H^+$  (proton) produced as a result of the reaction represented by formula (3) migrates through the proton conducting solid electrolyte membrane to reach the fuel electrode to undergo there a reaction represented by the following formula to produce hydrogen.



"as a result of the crossover, the subsidiary reaction where methanol permeating from the fuel electrode is oxidized by oxygen on the surface of catalyst coated on the air electrode as represented by the following formula.



"supply of oxygen (air) is decreased, and when the open-circuit voltage is 300 to 800 mV, hydrogen evolves. However, this is probably because the oxidation of methanol permeated to the air electrode as represented by formula (6) is suppressed, evolution reaction of  $H^+$  as represented by formula (3) becomes dominant, and the  $H^+$  undergoes reaction represented by formula (4) to produce hydrogen." ([0143])

Accordingly, in the invention set forth in claim 48, reactions of  $\text{CH}_3\text{OH} + \text{H}_2\text{O} \rightarrow \text{CO}_2 + 6\text{H}^+ + 6\text{e}^-$  at the cathode (oxidizing electrode), and  $6\text{H}^+ + 6\text{e}^- \rightarrow 3\text{H}_2$  at the anode (fuel electrode) occur, and even if electrons ( $6\text{e}^-$ ) are not supplied from the outside, hydrogen gas ( $\text{H}_2$ ) is generated in the anode (fuel electrode).

Therefore, in the invention recited in claim 48, regarding the "hydrogen generating device", it is important to provide "means for collecting the hydrogen containing gas from the fuel electrode" at the anode (fuel electrode), which differs from the invention of Kosek.

The subject matter of claim 48 resides in that hydrogen is generated at the anode (fuel electrode). However, Kosek only shows that the hydrogen is generated at the cathode (oxidizing electrode), and does NOT show at all that hydrogen is generated at the anode (fuel electrode).

Additionally, while the invention as defined by claim 48 provides "means for collecting the hydrogen containing gas" in the anode (fuel electrode), the invention of Kosek provides "means for collecting the hydrogen containing gas (GENERATED  $\text{H}_2$ )" at the cathode (oxidizing electrode) (see Fig. 1 of Kosek). Accordingly, the position providing the "means for collecting the hydrogen containing gas" is the very opposite.

Also, in the invention of claim 52, electric energy ( $\text{e}^-$ ) is supplied from the outside to generate  $\text{H}_2$  by the reaction which is the same as that of Kosek. However, at the same time, unrelated to the electric energy ( $\text{e}^-$ ) which is supplied from the outside, due to the above-mentioned reactions (3) and (4),  $\text{H}_2$  is generated in the anode (fuel electrode).

Therefore, in order to be used as "a hydrogen generating device", it is important to provide the "means for collecting the

hydrogen containing gas from the fuel electrode" in the anode (fuel electrode) in the same fashion as the invention of claim 48.

Also, the effects of the subject matter of claim 52 are described in paragraph [0241] of the present specification such that

"Relation of the rate of hydrogen evolution with the current density applied in the test is shown in Fig. 43.

It was found that the efficiency of hydrogen evolution (efficiency of hydrogen evolution relative to electric energy supplied) becomes equal to or more than 100% (100% efficiency of hydrogen evolution is represented by the dashed line in Fig. 43) in certain areas when the current density is kept not more than 40 mA/cm<sup>2</sup>. This suggests that it is possible to obtain hydrogen whose energy content is larger than the electric energy supplied from outside by operating the cell in those areas."

Accordingly, the subject matter of claims 48 and 52 is not obvious over the disclosure of Kosek.

Also, since claims 67, 69, and 72 depend from claim 48, claims 67, 69, and 72 of the present invention are patentable over the arrangement disclosed in Kosek for at least the same reasons advanced in connection with claims 48 and 52.

Regarding the rejection of claims 54-56, 58, and 65, the Examiner asserts that the ground of the rejection is based on the disclosure regarding electric pressure and temperature in Kosek. However, as mentioned above, since the principle of the invention of Kosek and that of the present invention differ, this position is deemed incorrect.

Therefore, for at least the same reasons advanced above, claims 54-56, 58, and 65 of the present invention are not rendered obvious in light of the disclosure of Kosek.

Regarding the rejection of claim 71 of the present invention, Examiner asserts that the ground of the rejection is based on the

disclosure regarding electrolysis of sulfuric acid in Kosek. However, for the same reasons advanced above, this position is also submitted as being incorrect.

Also, Lehmann et al. (US 2002/0036147) relates to electrolysis of a hydrogen peroxide solution, and does NOT have any relation with the claimed invention which uses hydrogen peroxide as an oxidizing agent for organic matter.

Therefore, for the same reasons advanced above, the subject matter of claim 71 is not rendered obvious by the disclosure of Kosek.

Regarding the rejection of claims 59-64 of the present invention, Examiner asserts that Kenet et al. (US 2003/0132097) or Allen (US 2003/0205482) is applied to Kosek. However, since Kenet relates to a desalination device and Allen relates to the electrolysis of water, the principles of Kenet and Allen differ from the principle of the present invention which is "a hydrogen generating device" used for a hydrogen supply system. Accordingly, Kenet and Allen do not contain any suggestion that would lead to the generation of hydrogen at the anode (fuel electrode) which characterizes the claimed invention in the manner outlined above.

Therefore, claims 59-64 of the present invention are not obvious even if the disclosures of Kenet and Allen are combined with those of Kosek, and are patentable under 35 U.S.C. 103(a). As a result, the rejection of the present invention should be withdrawn.

As to the issues raised in connection with 35 USC § 112 first paragraph, it is deemed that the above-comments assist in clarifying the operation of the claimed subject matter. Further, in connection with the issue pertaining to electricity being withdrawn, attention is called to the disclosure carried in paragraphs [0153] - [0157] of the originally filed specification.

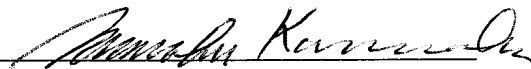
That is to say, the claimed hydrogen supply system is such as to function without a voltage which naturally appears across the anode and cathode being modified. Nevertheless, as clarified in paragraph [0157], for example, the amount of hydrogen which is evolved can be adjusted as a function of current or voltage being added or subtracted from the system.

As explained, claims pending in the application are patentable over the prior art references.

Reconsideration and allowance are earnestly solicited.

Respectfully Submitted,

KANESAKA BERNER & PARTNERS

By   
Manabu Kanesaka  
Reg. No. 31,467  
Agent for Applicants

1700 Diagonal Road, Suite 310  
Alexandria, VA 22314  
(703) 519-9785